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EXAMINER	
TALMAN, JAMES R	

ART UNIT	PAPER NUMBER
3737	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/710,555	PRIATNA ET AL.	
	Examiner	Art Unit	
	James R. Talman	3737	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 August 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9,11-13 and 15-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9, 11-13, and 15-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Receipt of amendment dated 8/16/2007 is acknowledged. Claims 10 and 14 are cancelled. Claims 1-9, 11-13, and 14-28 are pending.

Response to Arguments

2. Applicant's arguments filed 8/16/2007 have been fully considered but they are only partially persuasive.

3. On page 10 of Applicant's remarks it is argued that Ma does not disclose zero-filling in the slice direction.

4. The Examiner partially agrees with this argument. Ma discloses zero-filling a portion of k-space (column 5, lines 13-41), which can certainly be construed to mean any axis (phase encode, frequency encode, slice encode) of the k-space matrix, but does not explicitly mention the slice direction (slice encode). However, Haacke et al discloses zero-filling in 3D MRI imaging (3D imaging...zero filling, p. 812), as stated in the prior Office Action, and 3D MRI inherently incudes the slice direction (slice encoding).

5. On page 10 of Applicant's remarks it is argued that the Examiner failed to reject claim 27.

6. The Examiner respectfully disagrees with this argument, citing the third paragraph on page 14 of the prior Office Action, in which the rejection of claim 27 is included.

Specification

7. The objection to paragraph 39 of the specification is withdrawn.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the term "full-fat-recovery-free MR data" is vague and indefinite, because it could be interpreted to mean either fully fat suppressed MR data or MR data in which the data from fat has not fully recovered. Based on the Applicant's remarks, the Examiner requires replacing "full-fat-recovery-free" with --fat-suppressed-- for improved clarity.

10. The rejections of claims 21 and 25 under 35 U.S.C. 112, second paragraph, are withdrawn.

11. The rejection of claims 7 and 25-27 under 35 U.S.C. 112, first paragraph, are withdrawn.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. Claims 1, 12, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma (US6016057) in view of Weiss (US Patent Application Publication 2005/0165294).

As per claim 1, Ma discloses a method of medical imaging using zero-filling of at least a portion of k-space (column 5, lines 13-41), and also discloses using a fat suppression pulse to suppress signals from fat in an MR image (STIR technique, column 1, lines 19-37). Furthermore, data from the ROI must inherently be acquired at some point prior to full fat recovery, because in principle full fat recovery takes an infinite time to occur. Furthermore, it is inherently necessary to fill at least a portion of k-space with actual MR data because otherwise the entire k-space matrix would be full of zeros, and the reconstructed image would be entirely white or black, depending on the polarity of gray-scale mapping used. Ma does not explicitly disclose using a 3D fast gradient echo sequence (FGRE) to acquire the MR data. In the same field of endeavor (MRI), Weiss discloses 3D (three-dimensional diagnostic imaging scans, paragraph 42) fast gradient echo sequences (FGRE, paragraphs 34 and 43) to acquire MR data. It would have been obvious to a person having ordinary skill in the art at the time the invention was made to use a fast 3D FGRE scan to acquire MR data because fast imaging would allow collection of data before the signal from fat had recovered and 3D imaging provides better slice resolution and larger SNR, all of which is very well known in the art.

As per claim 12, Ma does not explicitly disclose any breath-holding requirement and therefore implies the use of a non-breathold technique.

As per claim 16, Ma further discloses imaging of the liver and breast (column 1, line 14).

14. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ma (US6016057) in view of Weiss (US Patent Application Publication 2005/0165294) and further in view of Ahluwalia (US Patent Application Publication 2005/0070785).

As per claim 11, and as applied to claim 1 above, the Ma/Weiss combination discloses all the elements of the claimed invention except that it does not explicitly disclose providing a threshold to define when the fat magnetization is deemed to have fully recovered. In the same field of endeavor (MRI), Ahluwalia discloses a threshold to define when the fat magnetization is deemed to have fully recovered (upper threshold for magnetization recovery for the suppressed tissue, paragraph 30; see also paragraph 35). It would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide a threshold to suppress noise and provide a mechanism for deciding the optimum number of pulses to use to suppress the signal from fat, as taught by Ahluwalia (paragraphs 30 and 35).

15. Claims 2-9, 13, 15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma (US6016057) in view of Weiss (US Patent Application Publication 2005/0165294) and further in view of Haacke et al (Magnetic Resonance Imaging, Haacke, E., et al., John Wiley and Sons, 1999).

As per claim 2, the Ma/Weiss combination discloses all the elements of the invention except it does not explicitly disclose using segmented data acquisition, multiple slice encoding lines, or repeating application of the fat suppression pulse.

Haacke et al discloses segmented data acquisition (Section 19.2, page 516). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify Ma to use segmented data acquisition in order to allow multiple lines of k-space to be acquired from each RF excitation of the sample.

Haacke et al further discloses slice encoding (phase encode the slice, Section 20.3.5, p. 594). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the invention of Ma to include slice encoding to permit 3D MR imaging.

Haacke et al further discloses an inversion recovery sequence using repeated application of the fat suppression pulse (Figure 17.5, page 428). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the invention of Ma to use repeated application of the fat-suppression pulse because the fat magnetization recovers somewhat over time and it becomes necessary to re-suppress it using a fat-suppression pulse.

As per claim 3, the Ma/Weiss/Haacke et al combination as applied to claim 2 above discloses all the elements of the claimed invention except that it does not explicitly disclose filling k-space with full-fat-recovery-free (interpreted by the Examiner as meaning fat-suppressed) MR data. Ma implies filling k-space with fat-suppressed data because a significant purpose of Ma is to suppress the signal from fat relative to

water (water and fat separation, see title; see also paragraph 3; water and fat images, 110, Figure 3). It would have been obvious to a person having ordinary skill in the art at the time the invention was made to fill all of k-space with fat-suppressed data because the resulting image after Fourier transformation would then be free of any chemical shift artifacts due to discrepancies between and fat and water magnetization properties, as is well known in the art.

As per claim 4, the Ma/Weiss combination does not explicitly disclose filling k-space from the center outward to the periphery. Haacke et al discloses a k-space trajectory starting near the middle of k-space and proceeding toward the periphery of k-space (Figure 10.16b, p. 192). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the Ma/Weiss combination to use the center-to-periphery trajectory taught by Haacke et al because larger signals occur near the beginning so the central part of k-space would have higher SNR and the resulting image would have better resolution of coarse objects in the resulting image.

As per claim 5, the Ma/Weiss combination does not explicitly disclose determining a flip angle such that fat signals are acquired at or near a null point at the filling of k-space. However, Haacke et al discloses determining a flip angle (inversion, Figure 17.6, p. 429) for the fat magnetization, followed by collecting data near the null point of the fat magnetization. It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the Ma/Weiss combination to collect data near the null point of the fat magnetization because it is where the fat signal is smallest, resulting in best contrast between fat and water, and to use the center-to-

periphery trajectory taught by Haacke et al because larger signals occur near the beginning so the central part of k-space would have higher SNR and the resulting image would have better resolution of coarse objects.

As per claim 6, the Ma/Weiss combination does not explicitly disclose a k-space trajectory proceeding generally from the periphery toward the center. Haacke et al further discloses a k-space trajectory starting near the periphery of k-space and proceeding generally toward the center of k-space (Figure 10.16c, p. 192). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the Ma/Weiss combination to use the periphery-to-center trajectory taught by Haacke et al because larger signals occur near the beginning of data collection so the peripheral part of k-space would have higher SNR and the resulting image would have better high-frequency edge contrast in the resulting image.

As per claim 7, the Ma/Weiss combination does not explicitly disclose determining a flip angle such that fat signals are acquired at or near a null point at the filling of k-space. Haacke et al discloses determining a flip angle (inversion, Figure 17.6, p. 429) for the fat magnetization, followed by collecting data near the null point of the fat magnetization. It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the Ma/Weiss combination to collect central k-space data near the null point of the fat magnetization because it is where the fat signal is smallest, resulting in better contrast between fat and water.

As per claim 8, the Ma/Weiss combination discloses all the elements of the claimed invention except that it only applies zero filling in the phase-encoding and

frequency-encoding directions and does not explicitly disclose zero filling in the slice encode direction. Haacke et al disclose zero-filling of 3D data (p.812). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the Ma/Weiss combination to include zero-filling of 3D data in the slice direction to improve the apparent resolution of the image in the slice direction.

As per claim 9, the Ma/Weiss combination discloses all the elements of the claimed invention except that it does not explicitly disclose using a spectrally-selective inversion recovery pulse. Haacke et al discloses a spectrally-selective (sinc pulse) inversion recovery pulse (Figure 17.5, p. 428). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the Ma/Weiss combination to include a spectrally-selective inversion recovery pulse because it only excites the spins significantly in a rectangular region, thereby reducing ghost artifacts in the final reconstructed image.

As per claim 13, the Ma/Weiss combination discloses all the elements of the claimed invention except that it does not explicitly disclose the use of sequential sampling and filling of k-space. Haacke et al discloses sequential sampling and filling of k-space (sequential ordering is the most commonly used ordering of phase encoding steps, p. 191; also see Figure 10.16a, p. 192). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the Ma/Weiss combination to use sequential sampling and filling of k-space as it is the most conventional approach and is well known in the art.

As per claim 15, the Ma/Weiss combination discloses all the elements of the claimed invention except that it does not explicitly disclose the step of defining a 3D volume of interest and acquiring the data therefrom. Haacke et al disclose the use of 3D volumetric imaging using phase encoding in the slice direction in order to collect 3-dimensional data from a collection of voxels in instead of the more common approach of collecting data in 2-dimensional slices. It would have been obvious to a person having ordinary skill in the art at the time of the invention to use 3D volumetric imaging, as taught by Haacke et al, in conjunction with the the Ma/Weiss combination in order to obtain higher spatial resolution in the slice encoding direction than using conventional 2D imaging.

As per claim 17, the Ma/Weiss combination discloses all the elements of the claimed invention except that it does not explicitly disclose the step of reconstructing a magnetic resonance angiography image from the MR data. Haacke et al disclose the method of magnetic resonance angiography (p. 12). It would have been obvious to a person having ordinary skill in the art at the time of the invention to apply the Ma/Weiss combination to magnetic resonance angiography in order to image blood vessels.

16. Claims 18-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma (US6016057) in view of Haacke et al (Magnetic Resonance Imaging, Haacke, E., et al., John Wiley and Sons, 1999).

As per claim 18, Ma further discloses an MRI apparatus with substantially uniform fat suppression (reliable water and fat separation can be achieved..., column 11, line8), using gradient coils (14), an RF transceiver system (36), an RF switch (24), a

computer (10) programmed to define the ROI, zero-filling of at least a portion of k-space (column 5, lines 13-41), and applying a fat-suppression pulse (STIR technique, column 1, lines 19-37). Furthermore, Ma inherently discloses acquiring MR data prior to full fat recovery (or "less-than-full-fat-recovery") because in principle fat takes an infinite length of time to fully recover and therefore data is always acquired prior to full fat recovery. Ma does not explicitly disclose zero-filling in the slice direction or repeated application of the fat suppression pulse.

Haacke et al discloses zero-filling of 3D data in the slice direction (p. 812). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the invention of Ma to include zero-filling of 3D data to improve the apparent resolution of the image in the slice direction.

Ma does not explicitly disclose repeatedly applying the fat suppression pulses. Haacke et al discloses an inversion recovery sequence using repeated application of the fat suppression pulse every TR seconds (Figure 17.6, page 429). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the Ma/Weiss combination to use repeated application of the fat-suppression pulse because the fat magnetization recovers somewhat over time and it becomes necessary to re-suppress it using another fat-suppression pulse.

As per claim 19, Ma does not explicitly disclose any breath-holding requirement and therefore implies the use of a non-breathold technique.

As per claim 20, the Ma/Weiss combination does not explicitly disclose the use of sequential sampling and filling of k-space. Haacke et al discloses sequential sampling

and filling of k-space (sequential ordering is the most commonly used ordering of phase encoding steps, p. 191; also see Figure 10.16a, p. 192). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the Ma/Weiss combination to use sequential sampling and filling of k-space as it is the most conventional approach and is well known in the art.

As per claim 21, Ma further discloses a fully fat-suppressed medical image (water and fat images, 110; Figure 4).

As per claim 22, the Ma/Weiss combination does not explicitly disclose using a spectrally-selective inversion recovery pulse. Haacke et al discloses a spectrally-selective (sinc pulse) inversion recovery pulse (Figure 17.5, p. 428). It would have been obvious to a person having ordinary skill in the art at the time of the invention to include a spectrally-selective inversion recovery pulse because it only excites the spins significantly in a rectangular region, thereby reducing ghost artifacts in the final reconstructed image.

As per claim 23, Ma discloses a computer (10), defining a slice direction (column 12, line 65), zero-filling a portion of k-space, zero-filling of at least a portion of k-space (column 5, lines 13-41), and applying a fat-suppression pulse (STIR technique, column 1, lines 19-37). Furthermore, Ma inherently discloses acquiring MR data prior to full fat recovery (or "less-than-full-fat-recovery") because in principle fat takes an infinite length of time to fully recover and therefore data is always acquired prior to full fat recovery. Ma does not explicitly disclose zero-filling in the slice direction or repeated application of the fat suppression pulse.

Haacke et al disclose zero-filling of 3D data in the slice direction (p. 812). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the invention of Ma to include zero-filling of 3D data to improve the apparent resolution of the image in the slice direction.

Haacke et al further disclose an inversion recovery sequence using repeated application of the fat suppression pulse every TR seconds (Figure 17.6, page 429). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the invention of Ma to use repeated application of the fat-suppression pulse because the fat magnetization recovers somewhat over time and it becomes necessary to re-suppress it using another fat-suppression pulse.

As per claim 24, Ma does not explicitly disclose sequentially sampling and filling the non-zero portions of k-space. Haacke et al discloses sequential sampling and filling of k-space (sequential ordering is the most commonly used ordering of phase encoding steps, p. 191; also see Figure 10.16a, p. 192). It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify Ma to use sequential sampling and filling of k-space as it is the most conventional approach and is well known in the art.

As per claim 25, Ma does not explicitly disclose filling the center of k-space when the signal from fat is near its null point. Haacke et al discloses determining a flip angle (inversion, Figure 17.6, p. 429) for the fat magnetization, followed by collecting data near the null point of the fat magnetization. It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify Ma to collect central

k-space data near the null point of the fat magnetization because it is where the fat signal is smallest, resulting in best contrast between fat and water.

As per claims 26 and 27, the limitations of the claim are rejected for reasons similar to those stated with regard to claims 24 and 25 above, wherein the flip angle is determined as a function of a sequential sampling encoding scheme. The exact value of flip angle used to accomplish fat nulling is an obvious design choice that will depend on the particular value of TR chosen for the sequence, on the value of T1 for the fat being suppressed, and on the interval between the flipping pulse and the instant when fat nulling is desired, as discussed in Haacke et al (Section 18.1.1, pp. 454-460).

17. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kassai et al (US Patent Application Publication 2002/0188190) in view of Ahluwalia (US Patent Application Publication 2005/0070785).

As per claim 28, Kassai discloses an MR apparatus having means for exciting nuclei (transmitter, 8T) in a substantially uniform field (with the Larmor frequency, paragraph 6), acquiring 3D MR data during a breathold (breath hold during three dimensional scanning, see abstract), and a fat suppression pulse (paragraph 19).

Kassai et al does not explicitly disclose providing a threshold below which the fat magnetization is considered to be suppressed. In the same field of endeavor (MRI), Ahluwalia discloses a threshold to define when the fat magnetization is deemed to have fully recovered (upper threshold for magnetization recovery for the suppressed tissue, paragraph 30; see also paragraph 35). It would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide a threshold to

suppress noise and provide a mechanism for deciding the optimum number of pulses to use to suppress the signal from fat, as taught by Ahluwalia (paragraphs 30 and 35).

Conclusion

18. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James R. Talman whose telephone number is 571-270-3029. The examiner can normally be reached on 7:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Casler can be reached on 571-272-4956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Jrt

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